

C. S. Shantz  
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A CONTRIBUTION TO BRAIN  
SURGERY, WITH SPECIAL  
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BY

M. ALLEN STARR, M.D., PH.D.

PROFESSOR OF DISEASES OF THE MIND AND NERVOUS SYSTEM, COLLEGE OF PHYSICIANS  
AND SURGEONS, MEDICAL DEPARTMENT OF COLUMBIA COLLEGE, NEW YORK;  
CONSULTING NEUROLOGIST TO THE PRESBYTERIAN AND ORTHO-  
PÆDIC HOSPITALS, AND TO THE NEW YORK EYE  
AND EAR INFIRMARY.

*Reprint from the MEDICAL RECORD, February 1, 1896*

NEW YORK

THE PUBLISHERS' PRINTING COMPANY

132, 134, 136 WEST FOURTEENTH STREET

1896



# A CONTRIBUTION TO BRAIN SURGERY, WITH SPECIAL REFERENCE TO BRAIN TUMORS.<sup>1</sup>

BY M. ALLEN STARR, M.D., PH.D.,

PROFESSOR OF DISEASES OF THE MIND AND NERVOUS SYSTEM, COLLEGE OF  
PHYSICIANS AND SURGEONS, MEDICAL DEPARTMENT OF COLUMBIA  
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FIRMARY.

GENTLEMEN: Before entering upon the subject of operation for brain tumors, which I have been asked to discuss, I desire to say a few words regarding operative interference in cases of epilepsy. It is, of course, admitted by all that in ordinary idiopathic epilepsy with general convulsions, or with attacks of a *petit mal* type, there is no reason for any surgical interference. The only type of epilepsy in which a question of operation can arise is that of so-called cortical epilepsy, where an irritant lesion of one region of the brain produces localized spasms. Such lesions may be traumatic in origin, from fractures, localized meningitis, small hemorrhages, or cysts; or the epilepsy may be the first sign of a beginning tumor, abscess, or sclerotic patch. It is for this class of cases that operations have been very largely undertaken in the past and are still being done.

In my book on "Brain Surgery," published in March, 1893, I collected twenty-nine cases from literature and recorded thirteen cases of my own, in which operations had been done for the relief of this condi-

<sup>1</sup> Address delivered at the meeting of the New York State Medical Society, January 29, 1896.

tion. Thirteen of these were reported as cured. Since that time a very large number of cases have been reported, and I have had eight more cases operated upon. I will not take your time by any detailed statement of these cases, but wish to say that I am exceedingly disappointed with the final result of operations in this type of disease. Experience seems to show that, although after an operation a cessation of attacks may occur, these attacks are almost certain in the end to recur, and hence that the patients are not actually cured. Therefore I am becoming more and more reluctant, even in cases of well-defined cortical epilepsy, whether of traumatic or of spontaneous origin, to recommend surgical interference.

In cases in which the brain itself has been injured and a cicatrix has formed there exists a focus of irritation, and it is not possible by excision of this cicatrix to produce a result very different from that which is already present, for the cicatrix of the incision made by the surgeon is little different from that produced by a trauma, and hence in these cases I regret to say that little permanent effect is produced.

Turning now to the subject of brain tumors, it must be stated at the onset that the experience of investigators during the past three years has seemed to confirm the statement which I made in "Brain Surgery," that only about seven per cent. of tumors of the brain are open to operation. The difficulties in the way of operation in brain tumors are, first, the difficulty of locating the tumor accurately from the symptoms alone, and, second, the difficulty of reaching the tumor when accurate localization is possible.

There are a number of distinguished surgeons who have advocated a removal of a portion of the skull in every case where the diagnosis of brain tumor is made, irrespective of the possibility of locating the tumor, and irrespective of the possibility of excising it. The object of such an operation is to relieve the intra-

cranial pressure produced by the growth of the tumor and thus to relieve the symptoms of headache, vertigo, vomiting, and optic neuritis. The experience of many surgeons who have trephined for a brain tumor without finding it, but who have seen a certain amount of relief to these symptoms after an operation has led to this suggestion. Thus Park<sup>1</sup> and Horsley<sup>2</sup> have recorded cases in which considerable relief was obtained. Clarke and Norton<sup>3</sup> operated for the relief of pressure by taking out a section of bone from the parietal region. The headache and the optic neuritis subsided after the operation, but inasmuch as the tumor was not removed the symptoms gradually returned, and the relief lasted only about five months. Diller,<sup>4</sup> operating under the same circumstances, was not equally successful in relieving his patient, for the symptoms continued about the same after the operation, and the patient died a month later. Albert<sup>5</sup> reports three cases operated upon in this manner. In one there was no improvement whatever, in the other two a slight improvement, lasting through a month or six weeks, was obtained.

Horsley has urged this procedure very strongly and has even gone so far as to state that it may have a beneficial effect upon the growth of a tumor. He has recorded two cases in which relief of intracranial pressure has been followed, not only by a subsidence of the symptoms, but apparently by a progressive decrease and final absorption of the tumor; the patients recovering after a year from all cerebral symptoms.

I have recommended this procedure in one case at the Presbyterian Hospital in a patient seen with Dr. A. H. Smith, and subsequently operated upon by Dr.

<sup>1</sup> Dennis's "System of Surgery."

<sup>2</sup> British Medical Association, 1893.

<sup>3</sup> British Medical Journal, April 13, 1894.

<sup>4</sup> New York Medical Record, March 22, 1895.

<sup>5</sup> Wiener Medicinisch. Woch., 1895, Nos. 1, 2, 3.

McCosh. The man had all the symptoms of a tumor of the corpora quadrigemina, with very great distention of the ventricles, producing a tremendous increase of intracranial pressure. The removal of a considerable section of the skull from the parietal region relieved his headache for a few weeks, but had no effect upon the optic neuritis or upon the other symptoms, and he subsequently died.

These facts should certainly be considered in the management of any case of brain tumor. And while at first sight it may appear that the operation of trephining in such cases merely prolongs the life of a patient whose sufferings are extreme and whose death is sure to follow, and is in no sense curative, yet it is well known that surgeons undertake operations for the removal of tumors in other parts of the body, even when it seems probable that these tumors will recur; and there are many patients who prefer to take the risks of an operation in order to secure a longer lease of life. It is also to be remembered that a marked change in the circulatory conditions, consequent upon the relief of the intracranial pressure, may in some cases aid in the effect of the absorptive power of some drugs. For it is not to be forgotten that there are cases of brain tumor in which the diagnosis is perfectly certain, which have recovered under the use of mercurial inunctions together with very large doses of iodide of potassium. Oppenheim,<sup>1</sup> in his recent monograph on brain tumors, calls particular attention to this fact, and I desire to put on record a case which offers a striking confirmation of it. I do not allude in this connection to cases of gummy tumor, for I think it is generally admitted that under the American system of treatment by inunctions of mercury, continued to the point of salivation, and very large doses, as high as five hundred grains a day of iodide of potassium, gummy tumors can be absorbed. I have, per-

<sup>1</sup> "Die Geschwülste des Gehirns," Wien, 1896.



sonally, records of four such tumors absolutely cured and now under observation a year or more since the cure, and I have no doubt that my experience in this respect can be duplicated by many who are present.

The following case, however, is one in which syphilis could be absolutely excluded. The patient was a boy, sixteen years of age, of perfectly healthy parents, there being no direct or indirect history of syphilis in either parent, and the boy himself presenting no evidence, direct or indirect, of having had the disease. In March, 1895, he began to suffer from a disturbance of his eyesight, and it was noticed that his eyes had a peculiar appearance. He was taken to a certain specialist in New York, who immediately discovered muscular insufficiency and divided the internal recti without any relief. Two weeks later he began to suffer from very intense headaches, vomiting, and marked mental dulness, and it was noticed on every occasion that he staggered slightly in walking. Lateral oscillation of the eyeballs was then noticed, and his headaches, which increased in intensity, interfered with his sleep at night. On April 24th, when I first saw him in consultation with Dr. Story, of Flushing, L. I., the boy was very ill. He was confined to bed and any motion increased the intense headache from which he constantly suffered. He was extremely emaciated, and frequent vomiting was attended by great vertigo and prostration. His eyes were prominent, his pupils were dilated, there was a slight deviation of the left eye outward, he saw double, vision was reduced two-thirds, and there was very marked nystagmus on any lateral movement of the eyes. Examination by the ophthalmoscope revealed a double optic neuritis, with great distention of the veins but without hemorrhages in the retina. There was no paralysis of the face, but he complained of numbness in the left side of the face and some weakness in the muscles of mastication on the left side of the jaw.

His tongue deviated to the left. There were no paralysis or ataxia of the hands and no disturbances of sensation in the extremities or body. There was no paralysis or ataxia of the legs when at rest, and his knee jerks were normal. There was no clonus. On standing up, his head fell forward, but he was able to straighten it with some effort, holding it, however, somewhat forward and toward the left. He staggered painfully in standing and in walking, so that he was unable to walk without assistance. The staggering was of the type recognized as cerebellar. There was considerable ringing in the left ear, but his hearing was the same on both sides. He had had on three occasions retention of urine which had to be relieved by a catheter, and he was extremely constipated.

With these general symptoms of brain tumor, and with the local symptoms of cerebellar disease, together with an affection of the fifth, eighth, and twelfth nerves on the left side, it seemed evident that this boy must have a tumor involving the cerebellum and producing compression of the left side of the cerebral axis; a tumor, in a word, whose position was such as to make any operation absolutely impossible. In the absence of any history of syphilis it seemed proper to give an absolutely unfavorable prognosis, and yet to resort to inunctions and large doses of iodide as affording the only possible hope. These were immediately begun and the iodide rapidly run up to two hundred and fifty grains a day. A steady improvement began in about two weeks after the treatment was instituted, and by June 15th he was up and about, without headaches, without vomiting, and walking without assistance quite well. He still staggered slightly, however, with a tendency to go toward the left; his tongue still deviated to the left. The left side of his face was still hyperæsthetic and at times painful. His eyesight was improved and the optic neuritis was subsiding. The improvement went on



during the entire summer, and at present the boy is quite well, with the exception of nystagmus and a slight right facial paralysis which has developed slowly. The appearance of his eyes is such as to suggest the previous existence of a neuritis, though his sight is normal. He is still taking two drachms of the iodide of potassium daily.

This case then shows that even in some individuals where there is no history of syphilis medical treatment for a brain tumor occasionally succeeds. Whether this treatment may be aided by diminution of the intracranial pressure may be left an open question.

In three cases of cysto-sarcoma in which the diagnosis was confirmed either by operation or autopsy, I have seen very great improvement in the symptoms follow a course of treatment with mercurial inunctions and iodide of potassium. The only manner in which such relief of symptoms could have occurred must have been by an absorption of the fluid in the cystic spaces of the tumor. In another case of cerebellar tumor this treatment was, however, without effect.

It must, therefore, be admitted that anything which diminishes the intracranial tension in cases of tumor may relieve the symptoms for a time, hence trephining for the relief of pressure is justifiable.

Turning now, however, from symptomatic treatment to the radical cure of brain tumors by removal, it is to be remembered that the necessary preliminaries to any operation for brain tumor must be accurate diagnosis of its position and a reasonable possibility of reaching it.

First, in regard to the diagnosis, it is now possible to distinguish sharply between the general symptoms common to tumors in any location—such as headache, optic neuritis with consequent blindness, vomiting, vertigo, mental dulness, polyuria, and general exhaustion—and those that are strictly local in their significance, such as spasms, paralysis, the various forms of

aphasia, hemianopsia, anæsthesia, cerebellar staggering, rotary movements, and cranial nerve palsies. There is one local symptom not generally known to which I desire to call your attention. It was first pointed out by Macewen. It is a change in the percussion note elicited by auscultatory percussion of the skull. I can confirm Macewen's statement that on the side of the tumor or abscess there is sometimes found a clearer, higher-pitched, and more resonant note than upon the opposite side. This is not uniformly obtained. Horsley has recently noticed that tenderness to pressure is often found over a tumor when tenderness to percussion cannot be elicited. It is upon the local symptoms that the decision with regard to the possibility of operation distinctly rests. In a small proportion of brain tumors it seems easy to determine the fact that the tumor must lie in a definite position, and if that position is one upon the convexity of the hemisphere where access to it through the skull is easy, it seems justifiable to undertake an operation. Yet my own experience and that of other operators has convinced me that even in regard to these local symptoms mistakes are possible.

Thus in a patient operated upon by Dr. McBurney for me in November, 1895, a patient who had been carefully watched since May and had presented symptoms of a tumor located in the arm centre of the left hemisphere (*viz.*, all the general symptoms of brain tumor, and spasms beginning in and for a time limited to the hand and face, followed by temporary paresis), a large exposure of the cortex failed to reveal the existence of a tumor on or near it, and the subsequent autopsy showed that the tumor (a sarcoma) had lain deep within the centrum ovale and had invaded the basal ganglia, although the symptoms pointed distinctly to the cortex as its point of origin. I think it is still impossible to distinguish accurately between cortical and subcortical tumors, and that no practical

advance has been made in the differential diagnosis since the classical article of Seguin and Weir published in 1888.<sup>1</sup>

Another difficulty in the way of operation is the fact that the nature of the tumor is always a matter of uncertainty until the tumor is exposed. Thus in a case operated upon by Dr. McBurney for me in May, 1895, where every symptom pointed to a tumor of small extent in the leg centre of the right hemisphere, it was found at the operation that a very extensive glioma occupied both central convolutions and extended downward as low as the face centres, so vascular in its character as to make its incision or excision impossible, and so imperfectly defined in its extent as to make it impossible to accurately determine its limits. I am willing to admit that in a case such as this very extensive excision of the brain is possible. Thus in September last, in London, I saw Mr. Horsley cut out a portion of brain substance, measuring four inches by three inches in surface extent and one and a half inches in thickness, from the motor area of the brain for the relief of chronic congenital athetosis with paralysis, and by careful tying of the vessels before the brain itself was incised, the method employed being that of passing horsehair sutures with an aneurism needle deep into the brain and out again all the way around the contemplated incision, he caused little hemorrhage and the life of the patient did not seem to be endangered by the extensive loss of brain substance. It is also well known from the experience of treatment in brain abscess that a large amount of cerebral tissue may be lost without fatal result, and the experience of Von Bramann and of Czerny has confirmed the possibility of large excisions of glioma of the brain without loss of life. Yet here again the fact confronts us, that although the patient may recover from the operation, he does not recover from his disease,

<sup>1</sup> Amer. Jour. Med. Sci., July-Sept., 1888.

for symptoms of a permanent character remain, which insure a life of invalidism.

It is only when the tumor is small, lies on but does not invade the cortex, and can be removed without serious damage that the prognosis is absolutely good. This was the condition in an angioma removed by Dr. McCosh at the Presbyterian Hospital in November, 1894. The patient had developed epilepsy with maniacal attacks after a blow on the left parietal region which had left a very tender and painful spot on the skull. There were few symptoms of tumor, but trephining at this spot revealed the existence of a small angioma, easily removable. The boy recovered and has been entirely well ever since.

Secondly, coming now to the record of what has been done in the treatment of brain tumors by operation, I have summed up the results in the following table. This table is made from the list of brain tumors to be found in my "Brain Surgery" up to 1893 (ninety-seven in number) and from the lists of tumors here appended (sixty-five in number) which I have gathered from medical literature between 1893 and January 1, 1896.

**Table of Results of Operations for Brain Tumor.**

	Cere- bral.	Cere- bellar.	Total.
Total number of cases operated upon for brain tumor.....	137	25	162
Cases in which tumor was not found.....	39	9	48
Cases in which tumor was found but not removed.....	5	2	7
Cases in which tumor was removed and patient recovered.....	65	7	72
Cases in which tumor was removed and patient died.....	28	7	35

It will be seen that these cases fall into three categories:

1. Cases in which the tumor was not found at the operation. These cases number forty-eight, of which

thirteen only have been recorded within the past three years. The errors in diagnosis which have led to a futile operation have been in the majority of these cases inevitable. In many of the cases the symptoms have pointed to the motor area or to the cerebellum as the site of the tumor. The tumor has really lain either deep beneath the cortex, or at some distance from the motor region, or in the frontal lobes. Since tumors at some distance from the motor region may cause motor symptoms indirectly by irritation or by pressure, it seems impossible in some cases to avoid this first error. The occurrence of ataxia of a cerebellar type from lesions of the frontal lobes has led to the second error. Bruns<sup>1</sup> was the first to point out the fact that frontal lesions often cause ataxia of a cerebellar type, and this fact has been confirmed by Cenas,<sup>2</sup> Dinkler<sup>3</sup> and Hermanidas.<sup>4</sup> In a recent monograph on brain tumors, Bruns<sup>5</sup> has pointed out the differential points between frontal and cerebellar ataxia, as follows: frontal ataxia is often associated with hemiparesis or with monoparesis; there is usually a localized tenderness to percussion or to pressure over the frontal region; optic neuritis occurs late in the course of the disease, and mental dulness is an early symptom. In cerebellar ataxia there is rarely hemiplegia; there is no tenderness over the frontal region; optic neuritis with hemorrhage in the retina occurs very early in the course of the disease and is attended by blindness, and while other symptoms of brain tumor such as vertigo, vomiting, and slowness of pulse develop early, mental symptoms such as dulness and apathy occur late. These points should be

<sup>1</sup> Deut. Med. Woch., 1892.

<sup>2</sup> Loire Méd., March 15, 1893.

<sup>3</sup> Deut. Zeitsch. f. Nervenh., vol. vi., 435.

<sup>4</sup> Neurolog. Centralbl., 1895, p. 181.

<sup>5</sup> Gehirntumoren. "Realencyclopädie d. ges. Heilk." Encyclop. Jahrb., v. Bd., 1895.

noticed, inasmuch as a staggering gait has been supposed to be quite characteristic of cerebellar lesions. It is well known that operations for cerebellar tumors have a more unfavorable prognosis than those for tumors in any other portion of the brain. In fact out of twenty-five operations for cerebellar tumor, while seven cases have recovered from the operation and have lived a few weeks, but two have been really permanently benefited. It is possible, therefore, that operation has been refused to some cases which have been considered as cerebellar because of the gait, when as a matter of fact the tumor lay in the frontal region and was accessible. In a recent case of Stewart and Annandale<sup>1</sup> of successful operation for cerebellar tumor, considerable stress was laid upon the fact that the pain suffered was in the opposite frontal region. This is another indication of the intimate relation between the cerebellum and the frontal lobes. I think it is evident, therefore, that with regard to the cases in which tumor has not been found at the operation a more careful study of the symptoms might in future prevent mistakes.

2. The second class of cases are those in which a tumor was found at the operation but its removal was impossible. This was usually due to the nature of the tumor. In any case the nature of the tumor is a matter of uncertainty. Should it turn out to be a glioma it is often very difficult of removal, yet Von Bramann has recorded<sup>2</sup> a case of glioma in which three operations have been performed, each a year after the preceding one, with a consequent prolongation of the patient's life, and, as already stated, it is not dangerous to make large incisions into the brain. Cases in which the removal has been impossible, however, are cases where the tumor has been very diffuse, very vascular, and very large. In all these cases it seems to me that an

<sup>1</sup> Edinburgh Hospital Reports, 1895.

<sup>2</sup> Archiv für klin. Chir., li., 1, 1895.



earlier attempt at operation might have succeeded. It is noticeable that while prior to 1893 five such cases are recorded, since 1893 but four such have been put on record, and this appears to show that with greater care in the selection of cases for operation, and an earlier adoption of this procedure, this class of cases will be eliminated in the future.

3. We come now, thirdly, to the class in which tumor was successfully diagnosticated, was found at the operation, and was removed. These now number 107, with 72 recoveries from the operation—a very satisfactory record when it is remembered that the first case in which operation was undertaken occurred in 1885. It is to be recollected that statistics show that out of one hundred and twenty autopsies in a hospital, brain tumor is found in one case only, and I have already stated that only seven per cent. of brain tumors are open to operation.<sup>1</sup> Hence this record shows that the operation is now being undertaken in almost all suitable cases, and it is also a satisfaction to find that, in the cases more recently recorded, the percentage of recoveries from the operation is greater, and the percentage of final recovery from all symptoms of disease is also greater. It has been an objection to the operation, that even when tumors are removed they are liable to recur, and that the destruction of brain tissue produced before the removal renders the patient a helpless invalid under all circumstances. This statement, however, is erroneous; for sufficient time has now passed to warrant the assertion that many

<sup>1</sup> Thacher reports that in 512 autopsies at the Presbyterian Hospital from February 1, 1893, to January 10, 1896, there were four tumors of the brain and seven abscesses of the brain. In 4,000 autopsies made by Beadles in one of the insane asylums in England there were 45 cases of tumors of the brain. In 6,177 autopsies made by Beck in Heidelberg, tumors of the brain were found fifty times. In 13,411 cases in the Nervous Department of the Vanderbilt Clinic to date, brain tumor was diagnosticated 36 times.

patients are alive whose tumors were taken out successfully, four, five, or six years ago, and many other patients are now alive, free from all symptoms, from whose brains tumors have been removed. I cannot but feel that in the future the prognosis in such operations will be more favorable than it is at present, and that we have every reason to go on with this work of removal.

As we look over the history of the successful cases it is evident that the most favorable cases for operation are those in which the tumor has been situated in the motor region of the brain, producing first localized spasms and then localized paralysis, or in the speech area of the brain, or in the visual areas of the brain. In all these areas the local diagnosis is easy, accession to the cortex is easy, and removal of the tumor should not present many difficulties in the hands of a skilful surgeon.

In the following table will be found a list of the varieties of brain tumor operated upon during the past three years and the result.

**Table II. Variety of Tumor Removed and Results—1893 to 1896.—**

Variety.	Recovered.	Died.
Sarcoma.....	10	5
Glioma.....	3	1
Glio-sarcoma .....	2	0
Cystic .....	3	5
Tubercular.....	3	3
Gumma .....	1	2
Fibroma .....	0	1
Angioma.....	1	0
Not stated.....	3	4
	<hr/> 26	<hr/> 21

It is evident that sarcoma is a tumor most frequently removed at the operation, and with the best prognosis. There appears to be little difficulty in removing cysts, but subsequent results are less favor-

able, for it is not sufficient to evacuate the cyst which then refills, but its wall must be dissected out; and this can rarely be done without serious injury to the brain, which may be followed by hemorrhages or by the formation of an abscess. Thus in a case operated upon by Dr. McBurney for me in January, 1895, in which headache and attacks of spasms, beginning in the arm and extending to the face, then to the body, and finally becoming general, were the chief symptoms, these symptoms having developed subsequently to a blow on the head, which had not produced any fracture, trephining over the arm area revealed the presence of a cyst containing about two drachms of clear fluid. The wall of this cyst was removed. Two days later a gradually increasing hemiplegia and mental dulness indicated the existence of compression which was found on investigation to be due to a hemorrhage that had occurred from a small vein of the pia subsequently to the operation. About eight ounces of blood clot were removed from the surface of the brain, with immediate subsidence of the mental dulness and of the hemiplegia. The patient then went on to recovery and remained well for five months, when the spasms recurred. Investigation showed that another cyst had formed at the seat of the old one. This was evacuated and the attempt was then made to secure its healing from the bottom by packing and an open dressing. This appeared to succeed, but at the end of six weeks, when only a very small sinus remained, the boy suddenly went into a condition of coma and died, and the autopsy showed a third cyst which had formed beneath the others, had invaded a large area of the brain, and had ruptured, causing death. The cases reported from Australia, of cysts that are evacuated, are largely of the hydatid variety which we do not see in America. Many of these cases recover and do not recur.

In regard to glioma, it is to be stated that in order

to remove the glioma extensive excision into the brain is necessary. This need not prevent the operation, however, as vessels can be tied, either before incision is made, by means of an aneurism needle carrying a ligature deep into the brain around the tumor, or subsequent to its excision, as such vessels appear. It is a remarkable fact that even when glioma recurs it can be excised a second time or even a third time, as the cases of Von Bramann and Cleghorn prove. The probability of a return of a glioma after extirpation makes this fact important.

Tubercular tumors have been successfully removed from the brain, Krönlein having collected <sup>1</sup> fifteen such cases, in five of which permanent cure resulted. It must be admitted that this tumor is liable to recur, and hence the objection which Von Bergmann has made to this operation may be thought to be warranted, yet, on the other hand, there are several cases on record in which patients have lived three or more years after the removal of the tumor without any recurrence; therefore in any case in which it is evident that other organs beside the brain are not invaded by the tuberculous process operation must be considered justifiable. The question of operating for gummy tumors is also an open one. There is no question that many of these tumors can be absorbed by full antisyphilitic treatment. There are others, however, which appear to be so large as not to yield to medicines, and in these cases I do not think we should hesitate to operate, for in several cases already on record, after removal of the tumor antisyphilitic treatment previously ineffectual has resulted in complete recovery.

It is not my function to comment upon the surgical aspects of these cases, and yet my experience in brain surgery, now reaching over sixty cases of various kinds, leads me to urge the adoption of the flap operation

<sup>1</sup> "Zur operativen Chirurgie im Hirngeschwulste," Beiträge zur klin. Chir., xv., 25, 1895.

rather than the operation of trephining, and also leads me to warn those who have not had experience from entering upon this field of surgery. I cannot but feel from the observation of many cases that it is essential to success that these operations should be done in a hospital, and should be done only by those who have had considerable practice in the performance of these operations, both upon the cadaver and upon the living subject. In this way delay is avoided; shock, which is the most dreaded feature, is obviated, and the many complicating accidents of hemorrhages, etc., are more skilfully met.

**Table III. Tumors Successfully Removed.**—*Central Region.*—Verco, *Trans. of Australian Congress*, 1893. Cyst hydatid evacuated. Died.—Eskridge, *Jour. Amer. Med. Assoc.*, Sept. 30, 1893. Sarcoma of fronto-parietal region, partly removed. Patient died.—Springthorp, *Australian Medical Journal*, Oct., 1893. Sarcoma removed, recovered. Glioma removed, died.—Chisholm, *Australian Medical Gazette*, 1893, p. 38. Hydatid cyst removed. Two cases, both died.—Harrison, *British Medical Journal*, Dec. 23, 1893, p. 1368. Gumma removed, but patient died.—Parry and Davenport, *Australian Medical Gazette*, 1892, p. 315. Hydatid cyst evacuated. Death on 20th day.—Pauly and Jaboulay, *Lyon Médical*, Feb. 5, 1893. Cyst. Patient died four days later.—Cleghorn, *New Zealand Medical*, Jan., 1893. Recurrent glioma operated on four times with temporary improvement.—Diller and Buchanan, *International Medical Magazine*, Sept., 1893. Cyst. Patient recovered and improved.—Brigattie Albertoni, *Revista sper. d. fren.*, 1893, p. 1. Glioma. Patient much improved thirteen months later.—Annandale, *Edinburgh Medical Journal*, April, 1894. Sarcoma. Patient recovered and was well three years later.—Vierordt and Czerny, *Fortschr. d. Med.*, 1894, No. 13, vol. xii., p. 193. Subcortical tubercular tumor in motor region. Patient recovered from

first operation at which nothing was found, and from second operation one year later, at which tumor was removed; at end of one and a half years after removal of tumor patient was much improved.—Rossolimo, *Deut. Zeitschr. f. Nerv.*, vol. vi., No. 1. Cyst evacuated. Patient improved; living two months later.—Sweeney and Ancker, *North West Lancet*, July 15, 1894. Cyst evacuated. Patient recovered entirely.—Pel, *Gazette des Hôpitaux*, Jan., 1895. *Berlin klinische Wochenschrift*, Jan. 29, 1894. Fibroid tumor removed. Patient died.—Steele, *Jour. of the Amer. Med. Assoc.*, Jan. 27, 1894. Sarcoma. One year later patient had recovered entirely.—Dana, *Journal Mental and Nervous Disease*, 1895, June. Sarcoma, partly removed. Patient improved at end of one year.—Wood and White, *University Medical Magazine*, Jan., 1895. Subcortical glioma of arm area. Patient recovered.—Nixon, *Trans. of the Acad. of Med. of Ireland*, vol. xii., 1895. Gumma. Patient died one month later from hemorrhage.—Murray and Richardson, *Lancet*, March 16, 1895. Sarcoma. Patient recovered and was well nine months later. Riegner, *Deut. med. Woch.*, 1894, No. 23. Sarcoma removed, but symptoms remained some months later.—Grasser, *Deut. med. Zeit.*, 1895, No. 34. Cysto-sarcoma of the left motor area only partially removed without relief of the symptoms. Patient died four weeks later.—Gaykiewicz, *Neurolog. Centralbl.*, 1895, p. 181. Gumma. Patient recovered entirely.—Bremer and Carson, *American Journal of Medical Sciences*, Feb., 1895. Sarcoma. Removed in part. Patient died on seventeenth day.—Bruns, *Neurolog. Centralbl.*, 1895, p. 125. Sarcoma. Patient died of septic meningitis.—Beever and Balance, *British Medical Journal*, Jan. 5, 1895. Sarcoma of centrum ovale under motor region operated and largely removed, July 1, 1894. In November the patient was alive and improved.—Gibson, *Lancet*, Dec. 14, 1895. Glio-sarcoma, recovery.—Horsley,



*Clinical Journal*, Feb. 13, 1895. Tumor. Recovery six months later.—Roth, *Berlin. klinische Wochenschrift*, 1895, No. 41. Tumor. Patient recovered entirely.—Krönlein, *Beiträge zur klinischen Chirurgie*, xv., 251, Dec., 1895. Tubercular tumor. Patient recovered entirely.—Mya e Cadevella, *Il Policlinico*, March, 1894. Cyst removed. Complete recovery. Delorme et Schwartz, *Bul. d. l. Soc. d. Chir.*, Paris, April, 1895. Tumor removed. Patient improved.

*Temporal Region*.—Nicholaysen, *Annals of Surgery*, July, 1893. Sarcoma, temporal region. Recovery.

*Parietal Region*.—Colquhoun, *New Zealand Medical Journal*, July, 1890. Sarcoma, parietal region. Patient recovered from operation.—Rose, *Medical Press and Circular*, February 14, 1894. Sarcoma, parietal area, only partially removed. Patient died.—Starr and McCosh, *American Journal of the Medical Sciences*, November, 1894. Angioma, parietal area, removed. Patient recovered entirely. Is now well.

*Occipital Region*.—Rodgers, *Medical Times and Register*, 1888, ii., 343. Glio-sarcoma, occipital region, removed. Patient recovered, but symptoms remained.

*Region not Stated*.—Esteves, *Buenos Ayres Semane Medical*, 1894, May 17th. Cyst removed. Patient recovered.—Horsley, *British Medical Journal*, December 23, 1893. Tubercular tumor, found, removed. Patient lived two years. No return of brain symptoms.

*Cerebellum*.—Macewen, *British Medical Journal*, December 23, 1893. Three tuberculous tumors of cerebellum. Patients were much improved, but tumors recurred and caused death after some months.—Parry, R. H., *Glasgow Medical Journal*, July, 1893. Tumor of cerebellum partly removed. Child died.—Hermanidas, *Neurologisches Centralblatt*, 1895, p. 181. Tumor of cerebellum removed. Patient improved. Two tumors of the cerebellum found and removed.

Patients both died.—Stewart and Annandale, Edinburgh Hospital Reports, 1895. Sarcoma, right cerebellar lobe. Patient much improved two months later.—Munn, *International Journal of Surgery*, February, 1895. Tumor of the cerebellum found but not entirely removed. Patient died the next day.

**Table IV. Tumors Trephined for, Found but not Removed.**—*Central Region*.—Horsley, *British Medical Journal*, December 23d, 1893. Fibroma, motor zone, too large for removal. Death.—Bruzeliuss and Berg, *Centralbl. für Nerven.*, 1895, p. 529. Glioma of the central convolutions. Not removed. Patient died two months later.—Nicholson, *British Medical Journal*, December 23, 1893. Sarcoma of motor area, could not be removed and patient died.—Starr and McBurney. Glioma of central area too extensive and vascular for removal. Patient died ten days after operation.

**Table V. Tumors Trephined for but Not Found.**—*Frontal Region*.—Chipault, *Revue Névrologique*, 1893, p. 149. Glioma, frontal subcortical. Not found at operation. Died.—Fagnet and Lannelongue, *Mercredi Méd.*, 1895, No. 12. Right second frontal convolutions, subcortical gumma, trephined over motor region, died within a few days of operation.—Aldibert, *Revue de Chir.*, 1895, No. 2. Tumor of the first and second frontal convolutions. Trephining done over Rolandic region. Death three months after the operation.—Hermanidas, *Neurolog. Centralbl.*, 1895, p. 181. Tumor of the second frontal convolution supposed to be cerebellar. Patient died soon after operation.

*Parietal Region*.—Walton and Richardson, *American Journal of the Medical Sciences*, December 18, 1893. Aphasia. Tumor located in left parietal region not found at operation. Patient lived two months. Some relief of general symptoms for two weeks. At autopsy sarcoma at junction of parietal and occipital areas.—

Horsley, *British Medical Journal*, December 23, 1893. Tumor not found, but trephining in parietal region relieved symptoms. Died two years later; no tumor found at autopsy.—Gibson, *Lancet*, December 14, 1895. Glioma of corpora striata, not found. Died.—Schlesinger, *Neurolog. Centralb.*, 1895, p. 702. Trephined over the motor region. No tumor found. Patient living two months after the operation.—Sanger, *Neurolog. Centralbl.*, 1895, No. 10. Tumor of the inferior parietal lobule, trephining over motor region. Patient died seven months after operation.—Starr and McBurney, sarcoma of centrum ovale under motor area. Patient died ten days after operation.

*Region not Stated.*—Keen, *American Journal of the Medical Sciences*, January, February, 1894. Occipital tumor not found. Patient died four months later. Glioma of third ventricle not found. Patient died nine hours after operation. Tubercular tumor, motor area, not found. Patient died seven months later.











